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Cover

An artist concept of the Apollo Soyuz Test Project (ASTP) docking. One major objective of the program will be the inflight testing of a jointly-designed international docking mechanism.

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Letter from Washington

Dr. George M. Low

Dear Colleagues:

As we approach the countdown for the Apollo Soyuz Test Project, it seems appropriate to review what this historic effort means for the present and may promise for the future.

For one thing, this joint program with the Soviet Union inaugurates an entirely new order of international collaboration.

We are now preparing to carry out this summer the first international manned space mission. The flight will mark the culmination of the ASTP in which a universal docking system suitable for future spacecraft will be tested and evaluated by U.S. and Soviet vehicles.

This international docking system, jointly designed and then independently developed by American and Soviet engineers, not only opens the way to mutual assistance in space, but it also represents a bridge of opportunity for expanded cooperation with the Soviet Union. Ultimately, it may lead the way to a true international space effort by the major nations of the world.

The importance of this truly remarkable project should not be underestimated. We have invested about $250 million in the project. The cost to the Soviet Union can only be guessed at, but it probably exceeds our own since the Soviets have flown several precursor missions and are readying two spacecraft and two launch vehicles to our one.

ASTP may also signal that the Soviets are ready to expand their scope of collaboration with other nations, which so far has been limited to relatively minor projects with France, India, and the Eastern European States. They could certainly do so from a formidable base, for they clearly possess the most active space program in the world today, with an annual launch rate about four times that of the U.S. Moreover, their space program is the only one besides our own with a demonstrated capability for manned space flight and planetary exploration.

ASTP is a very difficult and a very important step in space cooperation. It is less than 10 years since man first rendezvoused and docked in space—when Neil Armstrong and Dave Scott met their unmanned Agena target in Earth orbit. Two manned vehicles first docked in 1969: Apollo 9's "Gumdrop" met its "Spider" in a dress rehearsal for a lunar landing. And now, in June, 1975, we are less than a month away from a flight involving two nations, with two different languages, with two different ways of life. I have watched from the beginning how we jointly struggled to communicate as we designed the docking system; how we learned to understand each other, and each other's language; how we worked together, trained together, and how we planned the flight. The progress has been tremendous. What started out to be a most difficult, even strained relationship has become a truly significant cooperative venture.

Contrary to some allegations, there is no technology transfer or giveaway in ASTP. Apollo, designed to go to the Moon, was necessarily more sophisticated than Soyuz, designed as an earth-orbited craft. But the project has been so structured, with its emphasis on operations rather than design or development, that the Soviets learn no more about Apollo than they already knew from our published literature, and certainly nothing about manufacturing processes and the like. The new system—the docking system—was itself jointly designed, with each side contributing as much as the other, but even the new system was independently manufactured in its own way by each side.

What is important is that we are learning how to work together, how to cooperate on a most complex project where the final report card will be visible to all. This first step should open the door for many more cooperative efforts so that we might jointly share some of the tasks—and the costs—of the exploration of space.

While cooperation between the U.S. and the Soviet is both desirable and logical if we are to build a true international space capability, we must also recognize clearly elements of both cooperation and competition in our dealings with the Soviets. We are striving to cooperate with them because we both live in a vast universe that must be explored, where new knowledge is to be gained for the benefit of all. We continue to compete with the Soviets in space exploration because accomplishments in space represent a measure of the state of our technology. And in today's world, the level of our technology is of paramount importance strategically, economically and politically.

I have just returned from a visit to the Soviet Union. While there, I went to the Baykonur Cosmodrome and saw the place where the first Sputnik was launched on Oct. 4, 1957, where Gagarin first left the Earth in 1961, and where the Soyuz for ASTP will be launched this July. I participated in a joint Flight Readiness Review, and initiated discussions for future cooperative space efforts with the USSR. We agreed to preserve the momentum of Apollo Soyuz, to work together in space on even more challenging tasks in the future, to accelerate the acquisition of knowledge and to share the benefits for the sake of all humanity. In the final analysis, cooperation in space could well be the key to cooperation on Earth and to the survival of our species.

Sincerely,

George M. Low

George M. Low
Deputy Administrator

Monthly NASA Highlights

Intelsat IV F-1 Successfully Launched

The eighth of a series of Intelsat IV commercial communications satellites was launched successfully aboard an Atlas-Centaur rocket from Cape Kennedy on May 22. Performance was nominal and placed the spacecraft in a satisfactory transfer orbit.

This launch was the second attempt to place a second Intelsat IV over the Indian Ocean. The launch of Intelsat IV F-6 on Feb. 20 failed during the Atlas portion of the flight. Following an investigation headed by the Lewis Research Center, which manages the Atlas-Centaur program, a number of changes were made to hardware and procedures concerned with the electrical disconnect between the Atlas booster and sustainer sections.

The Intelsat series of satellites provides commercial global telecommunications service to the 89-member International Telecommunications Consortium.

The global system of communications satellites currently consists of an Intelsat IV satellite operating in synchronous orbit over the Atlantic, Pacific and Indian Oceans and a spare Intelsat III or IV satellite over each area. The Intelsat IV F-1 will be the primary spacecraft in the Indian Ocean region, with the Intelsat IV F-5 as a backup.

Program of Stratospheric Research

A broad program has been begun to determine what effects natural and man-made pollutants have on the Earth's ozone layer in the stratosphere.

The program calls for using the high-flying U-2 aircraft, balloons, sounding rockets, and satellites to measure how much and what kinds of compounds and their decomposition products are present in the upper atmosphere. The data obtained will be used along with ground-based information to determine if the predictions of ozone depletion are valid.

The creation of a basic research program which leads to a fundamental understanding of the physical and chemical processes occurring in the atmosphere must be accomplished to assess the effects caused by human activity. A coordinated Federal effort will be made to develop new approaches to instrumentation and measuring systems for evaluating the ozone problem.

In response to a request from the chairman of the Federal Council for Science and Technology (FCST), NASA has accepted the leadership role of coordinating its program with the programs of other Federal agencies through the Interdepartmental Committee on Atmospheric Science (ICAS). NASA will also work closely with the task force on the Inadvertant Modification of the Stratosphere (IMOS) recently established under the Council of Environmental Quality.

NASTRAN—Safety Through Design

A program originally proposed by the Office of Aeronautics and Space Technology (OAST) to help design more efficient aircraft and space vehicles is now being used to solve a variety of structural engineering problems.

The computer program, called NASTRAN for NASA Structural Analysis, was developed by the Goddard Space Flight Center to analyze the behavior of structures under stress.

More than 70 industrial firms, universities, laboratories and government agencies are now using NASTRAN and estimate that the program results in a 60 percent improvement in predicting the behavior of components under stress. Most organizations using the new computer analysis technique report that it cuts calculation time by two-thirds.

NASTRAN provides a unique capability for using a computer in design analysis of large, complex structures. It is being used for dynamic modeling of high temperature gas-cooled reactors, for designing nuclear power plants that will float offshore, and for fast breeder reactor design analysis. NASTRAN also is employed to analyze the structural design of bridges, ships, and aircraft. And in a line of American automobiles and light trucks. NASTRAN helps design front suspension and steering linkages, contributing to automotive safety through design.

Small Astronomy Satellite Successfully Launched

The Small Astronomy Satellite Explorer (SAS-C) was successfully launched by a Scout launch vehicle from the San Marco Range on May 7. The Scout launch vehicle performance was nominal and placed the spacecraft in a satisfactory orbit. The launch vehicle is managed for NASA by the Langley Research Center.

The San Marco Range is an Italian-owned-and-operated launch platform located off the coast of Kenya, South Africa, in the Indian Ocean. This was the eighth successful launch from the San Marco Range, all of which have been conducted by an Italian launch crew.

A preliminary in-orbit checkout of the spacecraft was conducted, and all instruments are turned on and

operating. Initial quick-look data from the X-ray instruments has verified the existence of a transient X-ray source near the source Cen X-3 recently discovered by the X-ray detectors on the U. -5 spacecraft.

The SAS-C is the third spacecraft in the SAS series developed at the Goddard Space Flight Center. A unique feature of the SAS spacecraft is the use of a basic spacecraft control section design that can accommodate a number of missions and scientific instrument packages. The SAS-C carries an experiment package consisting of four instruments for studying X-ray sources within and beyond our galaxy.

Industry-Government Program to Test Noise Levels from Business Jets

The Federal Aviation Agency and the Environmental Protection Agency are participating with NASA in a program to measure the noise level of business class jet aircraft during landing approach maneuvers.

The aircraft industry, through the National Business Aircraft Association, has provided a Rockwell Saberliner, a Grumman Gulfstream II, and Gates Lear Jet and a Beech-Hawker 125, along with flight crews, for the tests. A Lockheed JetStar is being supplied by NASA. The cooperative industry-government program is directed toward establishing noise characteristics for this class of aircraft and determining the effectiveness of alternate landing approach procedures in reducing community noise levels.

In the flight tests, conducted at the Flight Research Center in California, each of the aircraft will fly four different types of landing approaches over a microphone array to obtain noise level information. Flight Research Center pilots will fly the test runs, with the company pilots acting as safety pilots.

Dr. Low Visits Soviet Union

Dr. George M. Low, NASA Deputy Administrator, was in Moscow for the Apollo Soyuz Test Project (ASTP) Flight Readiness Review on May 22.

At the review, Dr. Glynn S. Lunney, U.S. Technical Director of the ASTP mission, his Soviet counterpart, Prof. K. D. Bushuyev, and the U.S. and Soviet Joint Working Group chairmen briefed Dr. Low and senior space officials of the USSR on the status of ASTP, which is still on schedule for the July 15 launch date set three years ago.

Earlier in the week, Dr. Low visited the Soviet Baykonur Launch site in Kazakhstan. He was accompanied by John F. Yardley, Associate Administrator for Manned Space Flight; Arnold W. Frutkin, Assistant Administrator for International Affairs; Walter Kapryan, Director of Launch Operations, Kennedy Space Center, and by ASTP Technical Director Lunney.

Communications Satellite Launched for Canada

The Telesat-C spacecraft was launched successfully by a Delta 2914 three-stage launch vehicle from Cape Canaveral on May 7.

The Delta launch vehicle performance was normal, and Telesat, Canada, fired the apogee kick motor, successfully circularizing the orbit. All satellite systems are functioning normally. The Delta program is managed for the Office of Space Science by the Goddard Space Flight Center.

The Telesat-C is the third and last of a series of Canadian Domestic Communications Satellites operating in synchronous orbit to provide transmission of television, voice, data, etc., throughout Canada. It has been designated ANIK-III. Anik is the Eskimo word for brother. □

***Harmon Trophy Presentation**—President Ford is pictured in front of the 1974 Harmon International Astronaut's Trophy which he recently presented jointly to the members of the Skylab 2 crew. Standing on his right, they are, left to right, Capts. Paul J. Weitz, Charles Conrad, Jr., and Joseph P. Kerwin. Dr. James C. Fletcher, NASA Administrator, wearing dark suit, is standing in the back row, behind Kerwin's left shoulder.*

3 ASTP Demonstrations Planned

Three science demonstrations originated by the Marshall Space Flight Center—Chemical Reactions in Foams, Capillary Wicking, and Liquid Spreading—will be among technical investigations performed on the Apollo Soyuz Test Project (ASTP) mission in July. These will be in addition to the 27 experiments to be conducted on the flight.

For an investigation to be classified as an experiment, it must support science in general and must be approved by the Manned Space Flight Experiments Board after review by scientists of recognized competence in space research. A science demonstration is intended to illustrate or utilize unique conditions of space flight environment on an apparatus or process.

The demonstrations originated at MSFC will be conducted by the three U.S. astronauts taking part in ASTP. Investigators follow: Chemical Reactions in Foams, Dr. Philomena G. Grodzka, Lockheed Missile and Space Co., Huntsville, AL, under contract to MSFC, and Mrs. Barbara Facemire of MSFC; Capillary Wicking, Mrs. Ann Whitaker of MSFC; and Liquid Spreading, Dr. S. V. Bourgeois of Lockheed and Mrs. Facemire.

Science demonstrations performed on the ASTP mission will be recorded on motion picture film and made available for later showing in U.S. high school science classes. Films of demonstrations conducted on the three Skylab missions are now being used in many schools.

The demonstration on Chemical Reaction in Foams will involve the mixing of chemicals in zero-g. The mixture will be shaken to form a foam. After a certain delay, a chemical reaction will occur, turning the colorless foam to a deep red. The stability of the foam, as well as the time of reaction, will be noted and compared to ground-based studies.

The action of wicks is well known from oil lamps, candles, wet towels and tissues, and also from heat pipes which use the wicking action of surface grooves to transport the liquid from the cold to the hot end of the pipe. On Earth, the wicking action is always the result of two forces—adhesion and gravity. Even when the wicking proceeds horizontally, some influence of gravity exists. In orbit, the wicking action should proceed without the disturbing influence of gravity.

The purpose of the Liquid Spreading demonstration will be to show exactly how a liquid spreads over irregular surfaces under weightless conditions. Of particular interest will be the action of the liquids at the corners and junctions of plane surfaces, and the ability of the liquid to spread over vertical walls.

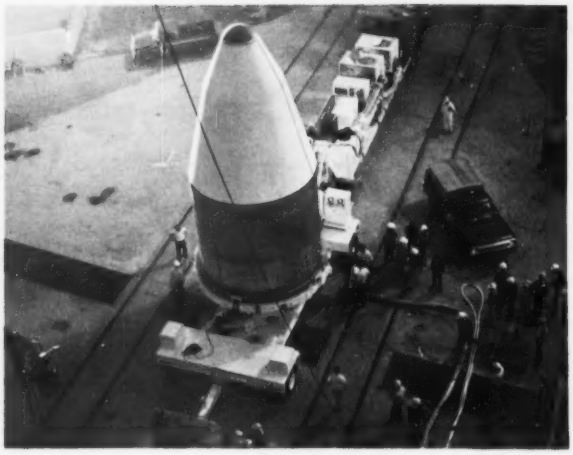
Metals for Shuttle Boosters Studied

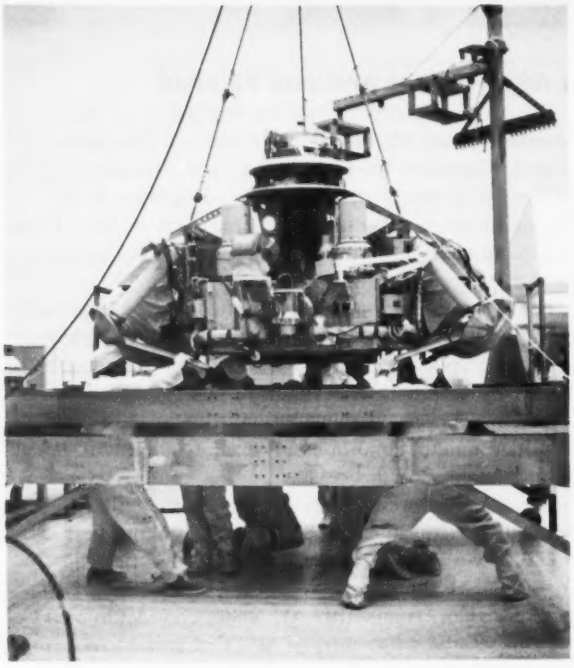
Research on metals conducted at the Marshall Space Flight Center is expected to give longer life to Solid Rocket Boosters of the Space Shuttle.

Dr. Pascal Noronha, working for the last year under an associateship awarded by the National Research Council and NASA, has been studying stress fracture mechanics and crack-growth in metals. As a result of research performed by him and by others at MSFC, the measurements of crack displacement are now several times more sensitive than before and can be recorded and interpreted in a few days instead of the several weeks previously required.

The Solid Rocket Boosters will be parachuted into the ocean after helping to lift the Shuttle toward orbit, and any cracks in metal would be subjected to an oceanic environment. Research was concerned with how different metals being considered for the boosters would perform after repeated periods of ocean exposure between flights.

In his research, Dr. Noronha attempted to create, detect and monitor the progress of cracks in test samples placed under stress and in a corrosive environment.





Mars, Here We Come!—*On August 11 and again on August 21, NASA will use a Titan III/Center launch vehicle, such as that shown beside the Verticle Integration Building at Kennedy Space Center in the upper left photo, to send two Viking automated spacecraft, like the one in the upper photo on the right, to the planet Mars. The picture at lower left gives a view of what will be inside each spacecraft—a Lander situated atop an Orbiter. The octopus-like scene at the lower right is of technicians checking the Lander's flight hardware before the final closure of the bottom plate.*

NASA Is Ready to Send Vikings Toward Mars

The Viking Mission to Mars, NASA's greatest effort to date to determine what actually exists on the planet looked upon as the most likely to harbor extraterrestrial life, will get underway with a double launch during August.

It will be the most ambitious unmanned planetary exploration ever attempted. Two automated spacecraft will be sent toward the Red Planet, the first on August 11 and the second on August 21. After an 11-month journey of 460 million miles, they will reach their destination and begin sending back data. The first of it is expected to be received in July, 1976, the month during which this nation will observe its 200th anniversary.

The goal of the mission is to supply scientific data never before obtainable. The spacecraft will perform investigations both from orbit and after an actual landing, with special emphasis on the search for life. Sophisticated instruments and miniaturized laboratories on board will perform 13 investigations.

Each spacecraft consists of an Orbiter and a Lander. On the Orbiters are three instruments: (1) a pair of high resolution television cameras; (2) an infrared spectrometer to detect atmospheric water vapor; and (3) an infrared radiometer that will determine the Mars surface temperature.

The three instruments will survey the pre-selected landing sites. In order to optimize a site for the biology investigation, an ideal area would be low, flat and wet. Based on the first Orbiter data returned, the site is certified, and the Lander will be commanded from Earth to separate from the Orbiter and begin its descent to the surface.

As the Lander plunges through the Martian atmosphere, a set of important measurements will be made. A mass spectrometer, a retarding potential analyzer, and pressure and temperature sensors are used to determine the physical and chemical structure of the atmosphere.

A pair of facsimile cameras mounted on the Lander will be used for taking 360-degree panoramic pictures of the area around the landing site. The cameras can cover an area as close as the footpad to 40 degrees above the horizon.

Three experiments will require sample "soil" from the surface. To obtain the sample, the Lander is equipped with a 10-foot retractable arm that can reach out and scoop up some Martian "soil" in its clam-like jaws located at the end, bring it back, and pour it into the canister-like laboratories.

The complicated biology instrument containing three separate experiments will search for any evidence of life. The instrument is a super-miniature laboratory about one cubic foot in volume and weighing around 35 pounds. It is equipped to perform three important experiments—tests for photosynthesis, metabolism and respiration.

Scientists have interpreted the Mariner 9 data as possible evidence of water in liquid form in Mars' recent past. Photos taken by the Mariner in 1971 have recharged the biologists' optimism. If any life exists, it is likely to be in the form of microorganisms.

A molecular analysis investigation will be performed to determine the chemistry of the atmosphere and the soil. Another miniature instrument, a gas chromatography/mass spectroscopy (GCMS), will be used to conduct the analysis.

The inorganic chemistry experiment will be performed by an X-ray fluorescence spectrometer. It will analyze the composition and character of the surface.

The pressure, temperature and wind velocity will be measured by sensors mounted on the top of a meteorology boom.

The radio science using radio signals will study the atmosphere, measure the surface properties, and determine certain celestial mechanics of Mars.

Any tremor on Mars' surface will be detected by a small, sensitive three-axis seismometer mounted on the Lander frame.

The physical characteristics of the planet's surface will be investigated by taking advantage of the instruments performing other measurements, such as motor currents on the surface sampler arms, pictures taken by the camera of the Lander's footpads, and temperature gauge on the Lander.

A group of magnets located on the sampling arm is used to pick up any magnetic particles that may be present on the surface. The cameras are focused to photograph the clinging particles.

To avoid any chance of the Mars surface being contaminated by Earth microorganisms carried on the Lander, the Viking management is following a most rigorous sterilization program. After each piece of hardware has been through several series of tests, it is sterilized separately and put on the Lander. Then the whole craft is rolled into a stainless steel chamber to be "cooked" for no less than 40 hours at 233 degrees Farenheit.

On May 13, a major review was held at Kennedy Space Center on the two Viking Landers' flight hardware prior to the final closure of the bottom plate. It was the last chance to discuss any changes or "fixes" before proceeding with sterilization. A thorough study was made of the pedigree of all components and their performance.

Attending the review were around 100 participants from NASA Headquarters, the science team leaders for the Lander instruments, members of a special Review Board, and representatives from other NASA Centers. Considering it very successful and establishing a high degree of confidence in the quality and health of Viking Landers, James F. Martin, Jr., of Langley Research Center, Project Manager, commented after it was over:

"Everything is going just great and right on schedule.

***Emblems for Viking**—The three emblems shown—an American Flag, the United States Bicentennial symbol (center), and the winning emblem designed by a student from high schools throughout the nation—will be carried on the Viking spacecraft when it sets out for Mars in August. In the other photograph, a technician at Kennedy Space Center prepares to place the student emblem, designed by Peter Purol of Baltimore, MD, on the Viking.*

This has been possible because of the remarkable spirit of cooperation among all the men from Lewis Research Center, Kennedy Space Center, Johnson Space Center, Martin Marietta Co. of Denver, and the Air Force."

But Dr. Edgar M. Cortright, Director of Langley Research Center, by which the mission is managed, added a word of caution: "We shouldn't get overconfident and believe that we always know what we are doing, and therefore make a mistake."

JSC Names Public Affairs Officer

Harold S. Stall, Manager of Corporate Public Relations for Celesco Industries, Inc., of Costa Mesa, CA, a diversified high technology manufacturer, has been named Public Affairs Officer of the Johnson Space Center. He will succeed Jack King, who recently resigned to join the Energy Research and Development Administration in Washington.

From 1966 to 1973, Stall, 38, was Manager of Public Relations and Advertising for the Hughes Tool Co.'s Aircraft Division, Culver City, CA. Prior to that, he was Deputy Commander of the Information Bureau of the Los Angeles County Sheriff's Department. He also has had experience as a newscaster and news director for several radio stations in the Los Angeles area.

ATS-6 Begins Moving for India Experiment

The Applications Technology Satellite-6 (ATS-6), largest and most powerful communications satellite ever built, began moving a third of the way around the globe the week of May 20 to take part in an instructional television experiment involving several thousand villages in India.

Launched into a geosynchronous orbit on May 30, 1974, the two-story-high spacecraft has been in a position above the Pacific Ocean just west of the Galapagos Islands. Its new location will be above Lake Victoria in East Africa.

The command to move was sent by the Goddard Space Flight Center through an ATS ground station in Rosman, NC. As the spacecraft crosses the Atlantic Ocean, electronic control of it will be transferred from Rosman to an ATS ground station in Madrid, Spain.

After the ATS-6 arrives at its new station about July 1, it will be checked out prior to its use in mid-July to track the Apollo and Soyuz spacecraft taking part in the Apollo Soyuz Test Project. It will relay television and data from the orbiting spacecraft to Earth, marking the first time a satellite has been used to relay television from a manned spacecraft to the planet's surface.

The satellite move is designed to bring it within range of India for the Satellite Instructional Television Experiment (SITE), a joint effort by NASA and the Indian Space Research Organization (ISRO) scheduled to be formally inaugurated August 1.

In this experiment, the spacecraft will be used by the Indian Government to relay daily TV programs to some 5,000 villages and cities in seven states throughout India. About half the villages will be equipped with TV sets augmented by converters and small antennas to receive the signal directly from the ATS-6. The others will receive the television signal after it is rebroadcast from a ground terminal in the area.

Shuttle Engine Tests Underway

After a lapse of several years, the rumble of rocket test firings can once again be heard at the National Space Technology Laboratories (NSTL) in Hancock County, MS.

A ground test version of the Space Shuttle Main Engine (SSME) is undergoing firings there in a modified stand once used to test stages of the Saturn V and Saturn 1-B launch vehicles used in Apollo and Skylab missions.

The Shuttle engines are being produced and tested by the Rocketdyne Division of Rockwell International Corp., Canoga Park, CA, under direction of the Marshall Space Flight Center.

Equal Opportunity Deputy Named

NASA has appointed Peter H. Chen, a principal adviser to the Director of Affirmative Action and Equal Employment Programs for the Brookhaven National Laboratory at Upton, Long Island, NY, as Deputy Assistant Administrator for Equal Opportunity Programs.

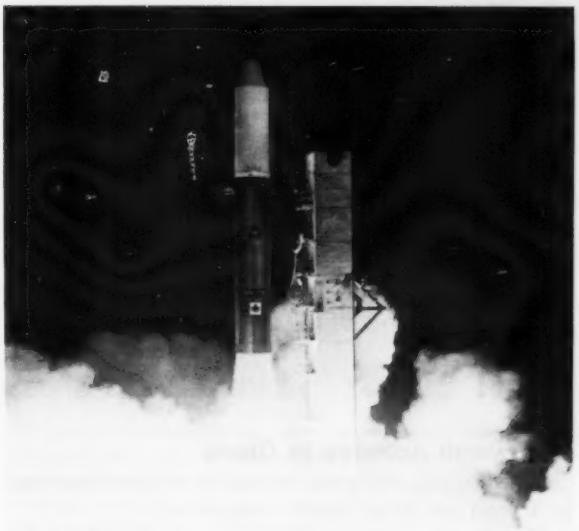
Before going to New York, Chen was employed by the Equal Employment Opportunity Commission in Washington, DC, as an Equal Opportunity Officer and later as a Technical Assistance Officer.

Flying Observatory Named for Kuiper

NASA's Airborne Infrared Observatory, the four-engine jet transport fitted with a 91.5 cm (36-inch) infrared telescope, was dedicated to the memory of the late Dr. Gerard P. Kuiper, founder and former Director of the Lunar and Planetary Laboratory at the University of Arizona, in special ceremonies at the Tucson International Airport at Tucson, AR, May 21.

Dr. Kuiper played an active role in NASA's early space programs, including the Ranger and Surveyor lunar missions, the Mariner 10 Venus/Mercury mission in 1973, and the Pioneer 10 missions to Jupiter. He was a pioneer in the field of infrared astronomy, particularly with the use of aircraft.

The flying observatory is an important part of the airborne astronomy program at Ames Research Center. In the future, it will be known as the Gerard P. Kuiper Airborne Observatory.



Delta Makes 100th Successful Launch

Launch early in May of the third Canadian communications satellite, Telesat-C, was another milepost in the career of NASA's "workhorse" rocket, the Delta, managed by the Goddard Space Flight Center.

Telesat-C marked the 100th time that Delta has successfully placed a spacecraft in orbit.

The rocket launched the nation's first communications satellite, ECHO-1, on August 12, 1960, and followed with a series of other communications, meteorological and scientific satellites that quickly caused it to be recognized as a dependable launch vehicle. Because of its reliability and economy, it has attracted a wide array of users, becoming the primary launcher for commercial spacecraft, international users and operational meteorological systems.

Over the years, Delta has achieved a 90 percent success rate, with failures attributed to "bad rides" (failing to achieve the proper orbit) rather than to explosions or "safety destruct" (purposely destroyed for safety).

Use of the Delta by other countries is credited with helping to ease the U.S. balance of payments by about $60 million. In the next few years, an additional $80 to $100 million will be paid to the U.S. by other countries for vehicles and associated services for their Delta-launched missions.

***Cousteau Visits FRC**—Captain Jacques-Yves Cousteau (center), famous ocean explorer, discusses an X-24B flight with Pilot John Manke (left) during a recent visit to the Flight Research Center. At right is former astronaut Russell Schweikart, who accompanied Cousteau on a tour of various NASA facilities.*

Honeywell Adheres to Goals

Schedule and cost goals are matters of first importance to at least one Space Shuttle subcontractor.

Honeywell's Aerospace Division at St. Petersburg, FL, is developing the Shuttle flight control subsystem under a $60 million contract to Rockwell International. During May, it reported that, after nearly two and a half years of work, it is only one day behind its planned schedule and within less than one percent of cost goals.

ASTP to Study Earth Mass Density Concentrations

A study of mass density concentrations in the Earth's upper layers, to be made from the orbiting Apollo spacecraft in the US-USSE joint Apollo Soyuz Test Project (ASTP) mission this summer, is expected to be helpful to scientists in understanding important aspects of Earth's evolution, including continental drift.

A Doppler tracking experiment will return data to be used in determining mass density anomalies of a magnitude that had not been detected by previous satellite or surface measurements.

Control Centers Hold Joint ASTP Simulations

A series of simulations between flight controls and Apollo-Soyuz crewmen in Houston and Moscow were begun May 13 in preparation for the joint flight in July.

The first simulation covered the period from one hour prior to the Soyuz launch time to 25½ hours into the mission. During this period of the actual mission, both the Soyuz and Apollo spacecraft will be launched and maneuvered.

Control center facilities in both countries were fully manned. This was the third time that they have been tied together with communication lines, the last previous exercise having been conducted in mid-March.

Communications between the two centers included voice, teletape, datafax and television. In each, flight directors, flight control personnel, specialists of other countries and mission support personnel required for interaction between the control centers, participated as in the actual flight.

A second simulation lasted 56 hours and covered the period in which will take place rendezvous of Apollo and Soyuz, docking of the two spacecraft, crew transfers, undocking and final separation.

The third and final simulation was a nine-hour exercise and included the rendezvous and docking of the spacecraft.

Final simulations, in preparation for the July 15 launch date, are scheduled for June 30 and July 1.

Holloway Named Space Director at Langley

Paul F. Holloway, Chief of the Space Systems Division at Langley Research Center since 1972, has been appointed Director for Space, Dr. Edgar M. Cortright, Center Director, announced.

In his new position, Holloway will be responsible for space and space-related programs at Langley, including space systems research, space applications and technology programs, the Scout launch vehicle, environmental quality programs, and environmental and space sciences research.

A recognized authority on entry flight mechanics and Earth orbital and planetary space missions, Holloway joined the Langley staff in 1960 following graduation from the Virginia Polytechnic Institute and State University.

Did You Know?

A program for testing the hearing level of all Langley Research Center employees has been initiated and will continue for about a year.

The first set of wings for NASA's Space Shuttle Orbiter has been moved from Grumman Aerospace Corp.'s facility at Bethpage, NY, via the Panama Canal to Palmdale, CA, site of the Orbiter's final assembly.

Lewis Research Center has awarded a contract to Burns Public Relations Service, a Cleveland-based minority firm, to document minority businesses in 16 Ohio counties and develop a minority firm directory.

When the Apollo spacecraft docks with the Soyuz spacecraft during the Apollo Soyuz Test Project mission in July and the three American astronauts join the two Soviet cosmonauts, it will be the first time five men have been together in Earth orbit. In October, 1969, the Soviet Union placed seven men in orbit at one time, but they were in three separate spacecraft and did not get together.

Two apparent low bidders on two major Space Shuttle contracts have been announced by the Kennedy Space Center. They are Frank Brisco Co., Inc., East Orange, NJ, with a bid of $8,733,300 for construction of the Orbiter Processing Facility, Orbiter Towway, and associated site work and utilities at KSC; and Santa Fe Engineers, Inc., Lancaster, CA, with a bid of $3,567,567 to construct Approach and Landing Test Facilities for the Space Shuttle Orbiter at Flight Research Center.

Tour volume at Kennedy Space Center and adjacent Cape Canaveral Air Force Station for the first four months of this year increased 72 percent over that for the same period in 1974.

***Russian Visitors**—Ralph Murphy (left) of the Marshall Space Flight Center explains eating arrangements in the Skylab Workshop to two Russian visitors, Inna Sheydina (center) and Anatoliy Derevyanko. The two were on a tour of the eastern United States with a group of 20 young Russian political leaders sponsored by the American Council of Young Political Leaders.*

The scientist who will be responsible for interpreting the pictures of the Earth to be taken by American astronauts when they go on the joint US/USSR ASTP mission this summer is recognized as one of the pioneer space photography interpreters. He is Dr. Farouk El-Baz, Director of the Smithsonian Institution's Center for Earth and Planetary Studies. A native of the Nile Delta region of Egypt, he has been studying pictures from space since 1969.

The percentage of total procurement dollars going to small business at the Marshall Space Flight Center has risen from 4.9 percent for FY 1973 to 9.8 percent in the first three quarters of FY 1975. The total amount involved was $24,234,000, an increase of 100 percent.

On May 6, Senator Frank E. Moss, Chairman of the Senate Committee on Aeronautical and Space Sciences, placed in the Congressional Record letters from three labor organizations supporting the Space Shuttle program.

The testing of a spacesuit-type isolation garment scheduled to have begun at Baylor College of Medicine in Houston, TX, in March, as mentioned in the April issue of NASA ACTIVITIES, has been delayed until an agreement is worked out between the Johnson Space Center and Baylor. □

Biology Instrument Successful

The biology instrument to be flown on Viking is one of the most difficult ever developed for an unmanned mission. Three experiments, tightly packed in a one cubic-foot, 35-pound package, contain test cells, valves, chemical solutions, a data system to replace the technician, and other equipment of a biology laboratory. Development of the instrument has attracted wide agency interest.

Last week, the flight hardware was subjected to its most rigorous test: terrestrial soil test in a simulated Mars environment. The test was enormously successful and demonstrated both the existence of micro-biological life on Earth and a successful instrument.

Naval Research Scientist Is ASTP Experimenter

Dr. Herbert Friedman, distinguished superintendent of the Naval Research Laboratory's Space Science Division, has a lot at stake on the July Apollo-Soyuz Test Project. He is the Principal Investigator for an experiment expected to map the celestial sky for soft x-ray sources.

Soft x-ray astronomy is a means of studying the structure of the Milky Way galaxy, as well as the intergalactic medium—gasses which exist between galaxies.

The Naval Research Laboratory experiment aboard the Apollo will provide 10 days of observations, or hundreds of times more observation than 11 previous rocket experiments. Because of the extended time for observation, resolution six times greater than previously obtained on rocket flights and large gains in sensitivity are expected to result.

Dr. Friedman says the field of soft x-ray astronomy is important because soft x-rays are peculiar to many cosmological happenings in and out of galaxies.

In his work, Dr. Friedman has traced solar cycle variations of x-rays and ultraviolet radiations from the Sun, revealed the x-ray emission of solar flares, produced the first x-ray and ultraviolet photographs of the Sun, discovered the hydrogen geocorona and measured the UV flux of early-type stars. During the last decade, his efforts to map the sky for x-ray sources have discovered many new x-ray stars, x-ray galaxies and the x-ray pulsar in the Crab Nebula.

America-Peruvian Rocket Launchings

The United States and Peru launched 44 sounding rockets and balloons over South America in May to study Earth's atmosphere and ionosphere. The project was named "Antarqui" for the Inca god of flight.

Project Antarqui is a continuation of the NASA sounding rocket program conducted during the 1964–65 International Quiet Sun Year. In that program, scientific research rockets were launched off the west coast of South America from a sea-going launch platform.

In the more recent project, launchings were made from Chilca Launch Range south of Lima, Peru. Scientific experiments for the rocket payloads were furnished by both Goddard Space Flight Center and Wallops Flight Center.

Vance Heads New Manned Space Flight Post

James L. Vance, formerly Director for Resource Management in the Office of the Assistant Secretary of Defense, has been named Director of Resource Management Administration, a new organization in the Office of Manned Space Flight (OMSF) at Headquarters.

In announcing the appointment of Vance and establishment of the new organization, John F. Yardley, Associate Administrator for Manned Space Flight, said, "The new directorate will serve as a single point of resource management and control activity which will provide better service to the OMSF technical program offices."

OMSF technical offices include the Apollo Soyuz Test Project, Space Shuttle, Spacelab, Mission and Payload Integration, Advanced Programs, Quality and Safety, and Life Sciences.

The Resource Management-Administration Directorate was formed by combining the former Budget and Program Analysis Directorate and the Administration Directorate. The Program and Budget Control groups, formerly elements of the technical offices, also are part of the new directorate.

Experiments for Uranus Mission Sought

Scientists have been invited by NASA to propose experiments for a 1979 space mission that would fly a Mariner-type spacecraft past Jupiter and continue to Uranus, third largest planet from the Sun, and perhaps to the far reaches of the solar system.

The flyby of Uranus would provide man with his first closeup look at the distant planet, one of the most bizarre in the solar system: a mammoth ball of poisonous gasses spinning on its side.

The mission has not yet been finally approved but NASA seeks to solicit flight investigations early in order to initiate the necessary science planning and development.

As now proposed, the trajectory would begin on Nov. 3, 1979, with the spacecraft arriving at Jupiter at a flyby distance of 392,000 kilometers (245,000 miles) on April 10, 1981. Using the gravity of Jupiter to accelerate and redirect it, it would proceed to a mid-1985 encounter with Uranus, possibly coming as close as 24,000 kilometers (15,000 miles).

Investigations beyond Uranus would depend on the survival of the spacecraft.

***Complex 39 Marker**—Dr. Kurt H. Debus (right), former Director, and Gordon Harris, former Public Affairs Chief, stand beside the marker unveiled to designate the Complex 39 Press Site at Kennedy Space Center as an "Historic Site in Journalism."*

Complex 39 Press Site KSC Marked by Sigma Delta Chi

A plaque recognizing the Complex 39 Press Site at Kennedy Space Center as an "Historic Site in Journalism" was unveiled there recently by Sigma Delta Chi, national professional journalistic fraternity, in ceremonies attended by 150 of its members.

The inscription on the plaque reads: "The largest corps of newsmen in history gathered here at the Kennedy Space Center to watch and report fully and freely to the largest audience in history, with the full cooperation of the National Aeronautics and Space Administration, the U.S. space launchings to explore the Moon and the vastness of outer space."

As one of the highlights of the ceremony, Joseph L. Brechner, Vice President of Sigma Delta Chi Region 3 and President of the Central Florida Chapter, read telegrams from national leaders in the following order:

Florida Congressmen Lou Frey, Jr.: "It is a well deserved honor, and I join in commending you for your commitment to the free exchange of information and to the integrity you have continuously displayed in reporting our space program."

U.S. Senator Lawton Chiles, Florida: "There are far too many in government who insist that openness limits effective functioning. There is no better testimonial to the falseness of that charge than NASA."

U.S. Senator Henry M. Jackson, Washington: "If the news was good—as it was most of the time—NASA said so, in straightforward, objective terms. And if the news was bad, that was promulgated too, objectively, honestly, In their failures, as well as their successes, NASA personnel set a high standard for openness, a standard as historic as the space program itself."

U.S. Senator Richard Stone, Florida: "Congratulations* * * to NASA for the openness and candor that led to this special recognition."

U.S. Senator John H. Glenn, Ohio: "I am delighted that Sigma Delta Chi is commemorating the outstanding spirit of candor and openness that has characterized the Unites States space program since its inception."

During the ceremony, certificates recognizing their roles in the development of space exploration were presented Dr. Kurt H. Debus, former KSC Director, and Gordon L. Harris, former KSC Public Affairs Chief, both now retired.

Among veteran newspeople present were Howard Benedict, Associated Press writer, who in a short address told of news reporting difficulties associated with early missile launches; Martin Caidin, author-journalist, who presented the certificates to Dr. Debus and Harris; and Mary Bubb, who has covered more than 2,000 missile and space launches since 1967.

Canada to Build Shuttle Manipulator

Canada will develop at its own expense the Remote Manipulator System (RMS) that will permit astronauts inside the Space Shuttle Orbiter to deploy or retrieve payloads in space.

Cost for the development of the RMS has been estimated at $30 million. Delivery of the first flight unit will be made for use on early Shuttle orbital flights, scheduled to begin in mid-1979.

This arrangement with Canada parallels the one with the European Space Agency under which the Spacelab for the Shuttle is being developed with European funds.

Medical Imaging Conference Scheduled

An international conference on cardiovascular imaging and image processing, to review progress during the last five years in applying space-developed computer image enhancing techniques to a wide variety of medical diagnostic procedures, will be sponsored by NASA and the Stanford University School of Medicine at Palo Alto, CA, July 10–12.

The conference will bring together from throughout the world leaders and major contributors in this comparatively new field of medical research. They will exchange information and ideas and outline future needs.

Nine sessions covering three major categories of medicine—ultrasound, angiography and radioisotopes—will be held during the three-day meeting. Dr. Donald C. Harrison, Professor of Cardiology and Chief of the Stanford University Medical School Cardiology Division, and Dr. Harold Sandler, Chief of the Biomedical Research Division at Ames Research Center, will serve as co-chairmen.

***Space Briefing**—Leading science and social studies educators of the National Science Teachers Association and the National Council for the Social Studies were briefed on space program objectives and accomplishments at a special conference held recently at Kennedy Space Center. Here they are shown with Dr. James Ragusa, KSC's Chief of Planning and Analysis Function, Earth Resources Branch, standing at the far right. Standing at his right is Dr. Frederick Tuttle, Director of the Educations Programs Division, NASA Headquarters.*

Metric Guide Available

The sixth edition of "Information on the Metric System and Related Fields," produced by Marshall Space Flight Center in cooperation with the Metric Association, is now available.

References in the publication cover a bibliography of metric books and articles, metric legislation, film, film strips, training courses, posters, tools, etc. In addition, there are addresses to which to write for information.

The edition can be ordered for $2.25 per copy from the Metric Association, Sugarloaf Star Route, Boulder, CO, 80302.

Space Pictures Help States in Flood Relief

Pictures from satellites circling Earth 570 miles in space are being used to map areas currently flooded by the Mississippi River in order to help states assess damage caused to farm lands, forest and urban areas, as well as to assist them in planning disaster relief.

When floods struck this year, imagery from NASA's Earth resources satellites, LANDSAT-1 and LANDSAT-2, were delivered to the states affected within 36 hours of spacecraft passes over the flooded areas.

Data acquired by electronic scanners aboard the satellites were transmitted immediately to a ground station at the Goddard Space Flight Center and processed there into black-and-white transparencies. These pictures were then flown to the National Space Technology Laboratories (NSTL) at Bay St. Louis, MS, for further processing and analysis by Federal and State experts to measure the acreage inundated and to identify its land uses—urban, cropland, pasture or forest.

Experience aided in the effort. After the 1973 Mississippi River flood, which resulted in extensive damage and loss of life, Louisiana arranged for members of its State Planning Office to receive special training in remote image analysis at the Department of the Interior's Earth Resources Observation System (EROS) Applications Assistance Facility, operated at NSTL by the U.S. Geological Survey.

Computer-produced land use maps were obtained under a cooperative agreement between the Louisiana State Planning Office and the Department of the Interior.

When it became evident the 1975 flood posed a serious threat to Louisiana, arrangements were made for its previously trained personnel to use the EROS Applications Assistance Facility to delineate flooded areas, using LANDSAT imagery and existing maps and techniques.

Like Governor Edwin Edwards of Louisiana, Governors William Waller of Mississippi and David Pryor of Arkansas, whose states suffered considerable damage during the 1973 flood, also requested "real-time" satellite imagery and flood mapping from NASA.

Naugle Named Acting Associate Administrator

Dr. James C. Fletcher, NASA Administrator, has announced that Dr. John E. Naugle, Deputy Associate Administrator, will serve as Acting Associate Administrator in the place of Dr. Rocco A. Petrone, who is leaving the agency to become President and Chief Executive Officer of the National Center for Resource Recovery.

Naugle's appointment will remain effective until a permanent replacement for Petrone is announced.

Walter Bonney, NASA's First Information Director, Dies

Dr. Walter T. Bonney

Walter T. Bonney, employed originally by NACA and later made the first Directorof the Office of Public Affairs for NASA, died suddenly at his home at Frederick Md, on May 10. He was 65.

Recognized as one of the best government information officials in Washington and highly honored by his profession, he had a reputation for being dedicated to his work. He was largely responsible for the open program of information maintained by NASA.

In recalling Bonney's years with the agency, Dr. Eugene M. Emme, NASA Historian, said: "With a modest staff, he met the full thrust of the enormous pressure of the news media during the hectic early years of the space program. The launch of every sounding rocket was front-page news. NASA's projects, inherited from the International Geophysical Year (IGY) and the military services, plus its Project Mercury, kept Bonney at his desk long hours every day."

At the time of his death, Bonney was writing a history of the National Advisory Committee for Aeronautics (NACA), having completed his research, including numerous interviews with aviation notables, among them the late Charles A. Lindbergh and Vannevar Bush. He was the author of numerous articles and one book, *The Heritage of Kitty Hawk*, published in 1962.

Bonney joined NASA in 1949 as an assistant to Executive Secretary John F. Victory. He also worked closely at times with its Director, Hugh L. Dryden, and two of its chairmen, Jerome C. Hunsaker and James H. Doolittle. When NASA was created as the successor to NACA in October, 1958, he was named Director of the Office of Public Information.

In November, 1960, Bonney became Director of Public Relations for the Aerospace Corp., El Segundo, CA, and continued in that capacity until his retirement in 1971.

Satellite Scans Stars for Signals

Goddard Space Flight Center's Orbiting Astronomical Observatory (Copernicus) is scanning three nearby Sun-like stars for signs that other civilizations may be trying to contact us with ultraviolet laser beams. They are about 11 light years from Earth.

Bits and pieces of evidence from astronomy, physics and biology suggest that life is not a one-time accident of the universe, but that it can appear spontaneously in a favorable planetary environment and evolve into complex beings, provided vast amounts of time are available. Consequently, it is pointed out, the possibility exists that Earth is being irradiated from space by signals from intelligent civilizations on Earth-like planets circling other suns.

Since Earth's atmosphere prevents ultraviolet radiation from reaching the surface, laser observations can only be made from a space observatory. Copernicus has been orbiting Earth since 1972 at a distance of approximately 750 kilometers (450 miles).

Among scientists involved in the program is Herbert F. Wischnia of Stamford, CN, who has specialized in space optical systems since 1963. Last November, he scanned one of the stars, training a telescope on it for 14 orbits while the spectrometer scanned the ultraviolet spectrum for potential laser signals to Earth. The data transmitted from Copernicus back to Earth are now being analyzed.

***Among the Awardees**—These were scenes at the recent Headquarters Incentive Awards Ceremony. At left, Newton W. Cunningham accepts a White House Presidential Management Improvement award from Dr. James C. Fletcher, NASA Administrator, in behalf of the Mariner Venus-Mercury 1973 Management Team. In the photograph at right, Dr. Fletcher presents an Exceptional Performance Award to Arthur F. Hood, Supervisor of the Headquarters Printing Plant.*

25 Get Awards at Second Headquarters Ceremony

In its second Honor Awards Ceremony, NASA Headquarters on May 14 gave special recognition to 25 of its employees chosen by the Incentive Awards Committee on the basis of nominations submitted by their supervisors.

The recipients were cited as "women and men from technical and administrative fields, professionals and non-professionals, who have performed exceptionally well in their positions, who have voluntarily undertaken projects to better their communities, and who have fashioned reality from the concepts of creative management and equal employment opportunity."

The first ceremony of this type was held last September, at which 21 employees were recognized. In recalling it, Dr. James C. Fletcher, NASA Administrator, said:

"With science and technology as its background, our aeronautics and space program has often been considered the work almost entirely of scientists, engineers, technicians, and astronauts. Overlooked were the equally important administrative support functions and the people performing them. So we have undertaken to remedy that inequity."

Awards at the second ceremony were in four categories—Exceptional Performance, with 18 recipients; Equal Employment Opportunity, 3; Space-Ship Earth, 3; and Creative Management, 1.

In addition, a 40-year service certificate was presented Susanne S.T. Garner of the Financial Systems Division, Office of Financial Management. Also presented were two tokens of appreciation from the White House—a Presidential Management Improvement Award for the Mariner Venus-Mercury 1973 Management Team and a Presidential Management Improvement Certificate for the Facilities Engineering and Maintenance Division of the Office of Facilities.

The presentations were made by Dr. Fletcher, who was assisted in extending congratulations by Dr. George M. Low, Deputy NASA Administrator. William C. Schneider, Deputy Associate Administrator of the Office of Manned Space Flight and Chairman of the Incentive Awards Committee, presided over the ceremony and introduced Dr. Fletcher. The citations were read by James E. Kukowski of the Public Information Division.

Before making the presentations, Dr. Fletcher made the following statement:

"The women and men whom we honor today are already practicing what I find myself preaching more and more: '* * * We must accomplish what we have set out to do—doing it with reduced funds and maximum efficiency.' * * * These women and men have found ways to improve procedures, to avoid or lessen problems by anticipating requirements, and to take on additional tasks.

"And that is exactly what we need as we progress through this period of transition that is marked by economic belt-tightening and program restrictions. Last September, I stated our need this way: 'For us to succeed, each employee must live up to his responsibility, no matter how much out of the limelight she or he may be.' This becomes critical in the light of the reductions in staff we have undergone recently, of increasing costs, of budget uncertainties, and of continued shrinking of our dollars caused by inflation.

"But things are not altogether on the dark side. Although our FY 1976 budget includes no new program starts, that does not mean that we will not be a busy agency. Our budget will permit us to proceed with all of

our present major programs, such as the Space Shuttle, Viking, LANDSAT-C, aircraft energy reduction, and study of the problems of the stratosphere. And of course, in July, we participate in the first joint international manned mission as the Apollo Soyuz Test Project reaches its peak.

"Finally, regarding our budget, we have recently received news that Congress has acted on our authorizations and approved them essentially as requested. We are ready to carry forth our mission for another year."

The 25 recipients of awards follow by category:

Exceptional Performance Award—Herbert D. Broman, Chief of the Procurement Staff, Office of Space Science (OSS); Charles J. Donlan, Deputy Associate Administrator for Manned Space Flight (Technical), Office of Manned Space Flight (OMSF); Stephen Dwornik, Chief, Planetology Planetary Program, OSS; Kathleen M. Gibbard, Secretary, JT8D Refan Program Office, Office of Aeronautics and Space Technology (OAST); William J. Hamon, Senior NASA Resident Official at ESTEC, Netherlands, OMSF; Edith M. Hawley, Contract Specialist, Headquarters Contracts Division, Office of Headquarters Administration.

Arthur F. Hood, Supervisor, Headquarters Printing Plant; Joseph Labow, Chief, Patent Waiver Branch; Glenn L. McAvoy, Regional Inspector-in-Charge, Southwest Regional Inspections Office; Lavonne B. Parker, Personnel Exchange Officer, Office of International Affairs; Grace Bogart Reeder, Senior Reference Librarian, Headquarters Library; William E. Stuckmeyer, Director, Operations and Review Division, Office of Procurement; Edna Templeton, Administrative Technician, OAST; Patricia I. Thomson, Secretary, Communications Programs, Office of Applications (OA); Phyllis A. Wilson, Secretary, Military Aircraft Programs Office, OAST; and Roger L. Winblade, Manager, General Aviation Technology, OAST.

Equal Employment Opportunity Award—Henry W. Brady, Procurement Analyst, Office of Procurement; Louis B. Fong, Intergovernmental Affairs Officer, User Affairs Office, AO; and Herbert S. Snyder, Director, Headquarters Contracts Division, Office of Headquarters Administrationm

Space-Ship Earth Award—Richard L. Daniels, Director, Program Review and Resources Management Division, OSS; Dr. Frank D. Hansing, Director, Office of University Affairs; and Peter L. Robinson, Jr., Director, Graphics and Management presentations Division.

Creative Management Award—Gerald D. Griffin, Assistant Administrator for Legislative Affairs.

Seminar Held for Minority Businessmen

NASA technology and its potential impact on the market place was highlighted for the benefit of minority businessmen in the second of a series of "Technology Transfer Seminars," held recently at the Western Research Applications Center on the campus of the University of Southern California.

Representatives were present from firms engaged in metals manufacturing, electronics, sheet metals, chemicals and plastic. A key speaker was Hosea M. Alexander, Task Manager, Technical Application to Health Resources Planning, at the Jet Propulsion Laboratory, who was instrumental in using NASA technology in the design of the Dr. Martin Luther King Hospital in Los Angeles.

During the seminar, NASA's technology data bank was used to simulate actual business problems and to develop possible solutions.

Indonesia to Have Communications Satellite

Officials from the United States and Indonesia have signed an agreement for the launch in 1976 of the latter nation's first communications satellite.

Launched by a NASA Delta rocket, the satellite will be placed in synchronous orbit on the equator over Indonesia. It will reach 40 ground stations scattered among the 13,500 islands of the Republic of Indonesia, the world's fifth most populous nation.

The new satellite will allow Indonesia to develop a national communication network quicker and cheaper than by any other means, and is expected to assist significantly in that country's program of economic development, according to Indonesian officials.

Water Study Underway in Mississippi

By use of the satellite LANDSAT-II launched earlier this year, NASA is cooperating with the State of Mississippi in a study of that state's major water resources and the effects upon them of pollution.

Three data buoys placed along Pearl River transmit water quality data to the satellite, which relays the information to a tracking station at the National Space Technology Laboratories at Bay St. Louis, where it is fed into a computer and then relayed to a state computer at Jackson.

The satellite passes over the buoys every 12 hours. Within 15 minutes after it goes over them, the processed data is supplied to the Mississippi Air and Water Pollution Control Commission. State investigators can determine where a pollution source is by comparing the measurements from the buoys at different points along the river.

Satellites Open New Field of Business for the U.S.

Sales of Remote-Sensing Data to Domestic and Foreign Buyers Run into the Millions

Remote-sensing satellites of the LANDSAT series, circling the Earth at an altitude of about 570 miles as many as 14 times a day, have created a multimillion-dollar business for the Federal Government.

Some people say they may in time return all the money spent on the space effort—pay it back in hard money, for benefits from space technology are like snowflakes: uncountable.

The information these satellites are sending back to Earth is finding buyers all over the world, with U.S. industry the largest single user at the moment. Last year's sales amounted to almost $1 million, with new customers waiting in line. More than 110 countries, including the Soviet Union and COMMUNIST China, made purchases. It is an accepted theory that the security and prosperity of a nation depend upon its mineral-producing and agricultural industries.

What is happening is that the Earth, in effect, is being placed under a microscope. The satellites pass over any given spot on the globe every 18 days, recording data as they go and sending them back to a central ground processing facility at Goddard Space Flight Center for conversion into usable form.

The first satellite for this purpose was launched on July 23, 1972. It was the Earth Resources Technology Satellite (ERTS-1), now called LANDSAT. With its cameras in full operation, it began circling the Earth every 103 minutes, passing over a given spot always at the same local time and at the same altitude.

From its photographs came dramatic surprises. Uncharted lakes were discovered in Bolivia. Deeply-buried lineations were detected in the U.S. A flooded Mississippi River, largest in the nation, was visualized in graphic panorama.

Even before the remote-sensing activity began, the Federal Government anticipated the business it would generate. Space technology, it was realized, could be tailored to meet man's needs on Earth. Vegetation could be analyzed, natural resources spotted, environmental conditions studied. Farmers, geologists, land-use planners, cartographers, ecologists, geographers and environmentalists would have need for the data.

To take advantage of the new capability suddenly opened to the world, the Department of the Interior's U.S. Geological Survey, largest distributor of the data, established the Earth Resources Observation Systems (EROS) Data Center near Sioux Falls, SD. It is situated on a 318-acre site and designed to be an operational facility for generating reproductions for government agencies, commercial concerns, and the general public, including foreigners.

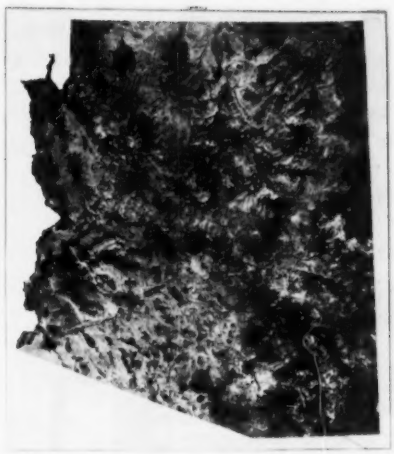
The Center has acquired and is using systems for semi-automated analysis of digital LANDSAT data for training and experimental purposes. The move to the permanent facility was completed Jan 1, 1974. Archives include approximately 500,000 items of LANDSAT and Skylab imagery, 1,400,000 items of NASA aircraft imagery, and 3,200,000 items of conventional and aerial photography.

Access to the data base is available through a computerized data management system. In the two years since the launch of the LANDSAT-1, the Data Center has supplied more than 430,000 copies of images to the user community, of which 243,000 copies were reproductions of LANDSAT images.

U.S. industry, the largest single user, accounts for 29 percent of the total sales volume. Foreign users buy 16 percent, with sales to them rapidly increasing. Various agencies of Federal, State and local governments account for 21 percent, educational institutions for 13 percent, and the man on the street 12 percent. The remaining 9 percent of users are unclassified.

The Center offers for sale items of imagery, photography, electronic data, and computer products collected by 16 different organizations, including NASA and the Geological Survey. LANDSAT, Gemini, Apollo, Skylab, NASA aircraft and aerial USGS aerial mapping photography are available. Moreover, care is taken to make sure the greatest benefit is gained from material, for hundreds of scientists from corporations, universities, government agencies and foreign countries come there to take courses on how to use the data.

The Geological Survey has made a concerted effort to see that the material is accessible to the public. General information on the availability of images and a price list of reproductions may be obtained from the User Services Unit, EROS Data Center, Sioux Falls, SD 57198, or from the National Cartographic Information Center, U.S.



Geological Survey, 507 National Center, Reston, VA 22092.

For as little as $2 and up, potential buyers can obtain photographs of any areas in which they are interested. Coverage photos are available so that particular sites can be designated by number.

Satellite image maps are now available of some areas. For instance, a mosaic of Florida, 44 by 58 inches in size and at a scale of one inch to each eight miles, is priced at $3 per copy and can be obtained from the Branch of Distribution, U.S. Geological Survey, 1200 Eads Street, Arlington, VA 22202.

Still another mosiac has been made of Arizona, 48 by 60 inches and an inch to each eight miles. It was prepared in black and white, at $1.25 per copy, and sepia, with cultural and drainage information overprinted, at $1.75. Orders should be sent to the Branch of Distribution, U.S. Geological Survey, Denver Federal Center, Building 14, Denver, CO 80255.

An image mosaic of the United States less Alaska and Hawaii, the first ever assembled from space imagery, is available for sale to the public in two types of reproductions—**photographic** and **lithographic**. Reproductions printed on stable-base photographic paper can be purchased at varying scales, sizes and prices: (for example, 1:5,000,000 scale—$20) from the Soil Conservation Service, Federal Building, Hyattsville, MD 20782. A one-sheet mosiac is available as a lithograph in either band 5 or band 7 from the U.S. Geological Survey (scale—1:500,000, that is 1 inch equals 79 miles). The actual size is 30 by 40 inches. It can be obtained at $1.25 per copy from the U.S. Geological Survey, Branch of Distribution, 1200 South Eads Street, Arlington, VA 22202.

Band 5 consists of images scanned to reproduce the red portion of the visible spectrum. This wavelength results in imagery most nearly like normal black and white pictures of cultural features. Band 7 imagery is scanned in the nonvisible near-infrared portion of the spectrum. This imagery is best for showing lakes, streams, marshes and other bodies of water which appear very much darker than any dry land features and vegetation that appears in light tones in the reproduction.

Over-the-counter orders and information are offered at the following offices:

Eastern Mapping Center, U.S. Geological Survey, 536 National Center, Reston, VA 22092.

Mid-Continent Mapping Center, U.S. Geological Survey, Box 133 (or 900 Pine Street), Rolla, MO 65401.

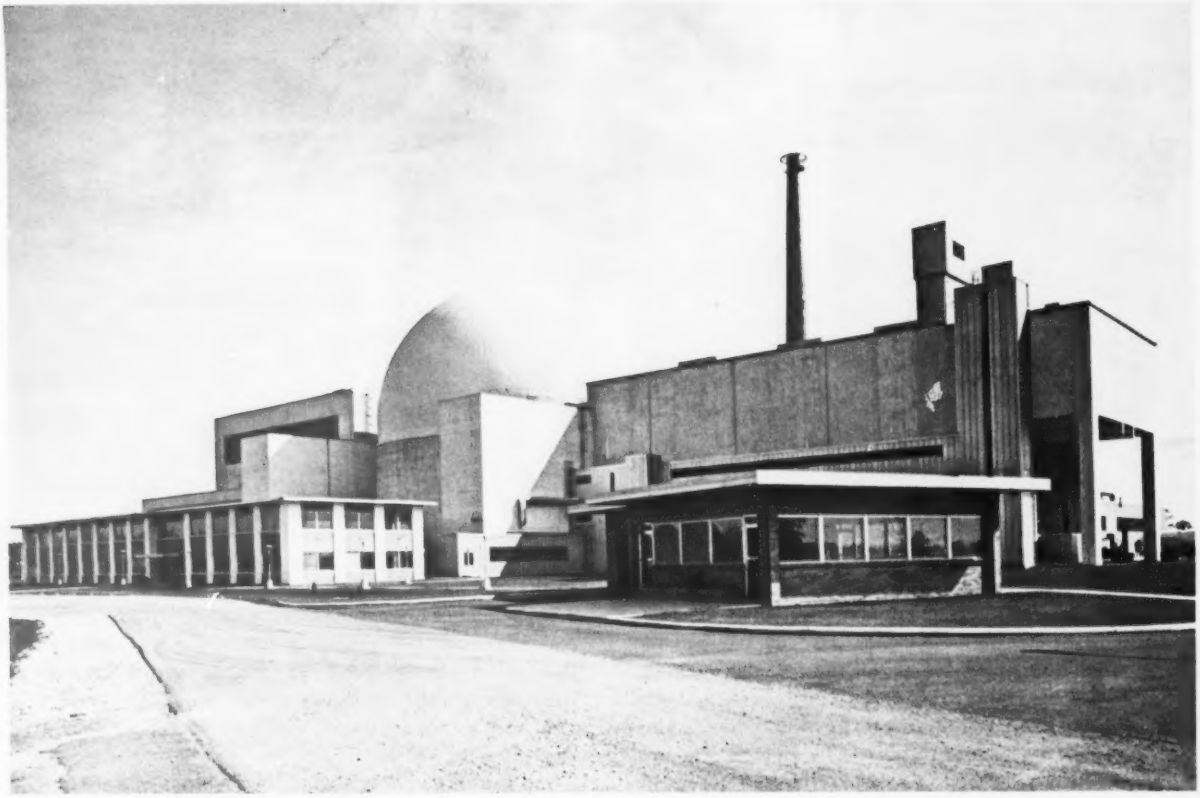
Rocky Mountain Mapping Center, U.S. Geological Survey, Federal Center, Building 25, Denver, CO 80225.

Western Mapping Center, U.S. Geological Survey, 345 Middlefield Road, Menlo Park, CA 94025.

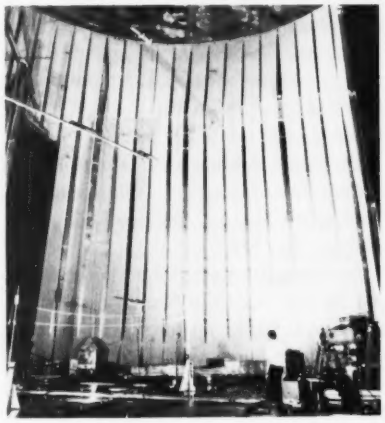
The new vistas opened by the satellites are now a live and thriving business. Their scope will broaden as new satellites are sent into orbit, each to perform a particular task. What lies ahead seems boundless.

On the strength of the potential and in response to urgent need for greater knowledge of the Earth and its resources, the first annual William T. Pecora Memorial Symposium will be held at Sioux Falls next Oct. 28-31. It will be sponsored by the American Mining Congress, U.S. Geological Survey, Society of Economic Geologists, and the American Association of Petroleum Geologists. Emphasis will be on applications of remote sensing to mineral fuel exploration.

Meanwhile, other countries are taking steps to get into the picture on a more individual basis. Canada and Brazil have built their own multi-million-dollar receiving stations. Italy has one under construction. Iran and Zaire are planning them. Other countries, including West Germany and Japan, are interested in the idea. The U.S., in addition to the central facility at GSFC, has stations at Goldstone, CA, and Fairbanks, AK.



***Where Clouds Are Studied**—Scientists at Lewis Research Center's Plum Brook Station have found it a convenient place to create clouds for study purposes. The picture at right is of the inside of the Space Power Facility, once used to test space vehicles and now used as a laboratory for the formation of clouds. The canvas strips are continuously dampened with water under regulated temperature. The lower photographs show the cloud forming, gradually blotting out the markers denoting the depth of the chamber.*



Plum Brook Facility Used in Cloud-Testing

Cloud-study, a new environmental research tool, is big business at Lewis Research Center's Plum Brook Station in Sandusky, OH.

More and more over the years, weather scientists have come to recognize that the microphysics of clouds is a valuable method by which man can modify his environment in almost any way he desires in order to live in harmony with it instead of destroying it.

They came to understand that clouds are a vital part of the environment and are difficult to study. To begin with, clouds have short lifetimes. They are delicate to the extent that a temperature change of only a few hundredths of a degree can destroy them. And they can be reached only by aircraft.

Consequently, scientists soon became convinced of the advantage of studying clouds in a laboratory where conditions could be carefully controlled and measured. That's where Lewis Research Center got into the picture.

The Space Power Facility at the Plum Brook Station, used to test space vehicles, was found to be just the facility the weather scientists needed. It is 100 feet in diameter and 120 feet tall. Moreover, it has the provisions for controlling accurately pressure, temperature and atmospheric composition.

This opened the way for an experimental program to study the effects of atmospheric contaminants on cloud formation. It was proposed by Pennsylvania State University's Department of Meteorology and is funded jointly by NASA and the National Science Foundation.

In the first phase of the program, the experimental hardware and techniques required to create stable, long-lived clouds in a test chamber, as well as to test their properties, had to be developed and demonstrated.

To be a useful research tool, clouds must be produced in a natural way; that is, by the adiabatic expansion of saturated air as it moves by invection to higher altitudes. Because of their extreme sensitivity to temperature, they must be generated within temperature tolerances of a few hundredths of a degree.

At Plum Brook Station, to provide cloud stability, a cotton muslin cylinder 96 feet in diameter and 80 feet tall was erected within the test chamber and continuously dampened with water at precisely the same temperature as the cloud. The judicious selection of pressure level, pressure reduction rate, and temperature permits generation of clouds of varied types and densities. Some have been formed there with lifetimes of as long as one hour in an environment free of convection currents.

In the next phase of the program, contaminants will be added to the atmosphere to measure their effect on the cloud formation process. And that should be when man begins to learn more specifically what he is doing wrong in his efforts to protect his environment.

Space Symposium—Here are two photographs taken at the recent "NASA Symposium '75," sponsored by NASA's Office of Equal Employment Programs, in cooperation with Shaw University and St. Augustine's College in Raleigh NC.

In the week-long program, seven minority colleges and universities sent student groups to participate in workshops and "rap" sessions relating to opportunities in the aerospace industry. Also attending were groups of junior high and high school students who saw demonstrations of space-related hardware and exhibits of space artifacts, and listened to informal lectures on science and space. Representing NASA were Dr. James C. Fletcher, Administrator; and Dr. Jarriett G. Jenkins, Assistant Administrator for Equal Opportunity Programs, and members of her staff, including minority and female experts.

Dr. Fletcher, at a news conference held in connection with the symposium, reiterated the goal of NASA to have a completely integrated work force, citing that its minority and female hiring goals almost doubled in the last fiscal year. In commenting on the symposium, Dr. Jenkins said, "If we have been able to present science and engineering as a real possibility in terms of career choices, than I have to conclude we were a success."

In the photo at top, Dr. Fletcher shakes hands with Dr. J.A. Hargraves, Shaw University President. Others in the picture, left to right, are Dr. Larnie Horton, representing North Carolina Governor James H. Holhouser, Jr.; Dr. Prezell Robinson, St. Augustine's College president; Dr. Jenkins; and Miles Fischer, Director of the National Association for Equal Opportunity in Higher Education. At center, Dr. Hargraves points out details of an Apollo spacecraft exihibit to students attending the symposium.

***Solar Activity and Climatic Change Specialist**—Mrs. Jeanette A. Scissum, employed in the Space Environment Branch of Marshall Space Flight Center's Space Science Laboratory, is in the process of compiling a report of solar activity. She also monitors and analyzes solar/geophysical data provided by observatories from all over the world.*

Lunar Sample Exhibits

The following is a schedule of lunar sample exhibits from June 15 to July 15, 1975:

California—Alameda County Agricultural Fair, Pleasanton, June 29–July 13.

Ohio—Armstrong Air and Space Museum, Wapakoneta, May 29–Sept. 4.

Michigan—American Freedom Train, Detroit, June 24; Grand Rapids, July 11; Kalamazoo, July 14.

New York—Rome American Revolution Bicentennial, Rome, NY, July 4–6.

Virginia—Danville Museum of Fine Arts and History, Danville, July 4–18.

Wisconsin—Centennial Celebration, Cuba City, June 12–15.

Texas—Houston Museum of Natural Science/History, End of Caroline at Hermann Park, Houston, June 15–July 15.

Long Term Displays

Alabama—Alabama Space and Rocket Center, Marshall Space Flight Center, Huntsville.

Florida—Visitor Information Center, Kennedy Space Center.

Kansas—Eisenhower Library, 200 SE 4th Street, Abilene.

New York—United Nations Building, New York City.

Ohio—U.S.A.F. Museum, Wright Patterson Air Force Base.

Texas—Johnson Library, University of Texas, Austin; Visitor Information Center, Johnson Space Center, Houston.

Virginia—Visitor Information Center, Langley Research Center, Hampton.

Washington, DC—National Geographic Museum; Smithsonian Institution, National Air and Space Museum, 1000 Jefferson Drive; Washington National Cathedral.

New NASA Publications

Applications Technology Satellite-6, a 12-page account of the versatile spacecraft that climaxes a NASA program that, since 1966, has advanced the frontiers of communications and meteorology. It is for sale by the Superintendent of Documents, Government Printing Office, Washington, DC 20402, for 45 cents per copy. (NF-53)

Apollo Soyuz Test Project is an eight-page description of the joint Soviet-American manned spaceflight mission and is for sale by the Superintendent of Documents for 30 cents per copy. (NF-52)

Apollo Soyuz Test Project is a four-color, 42-by-48-inch foldout wallsheet designed for classroom use. It describes the joint American-Soviet spaceflight mission and is for sale by the Superintendent of Documents for $1 each. (NF-51)

Radio-Television

(Released Nationally)

Television—A special 15-minute color film release in the *Aeronautics and Space Report* series: "Apollo Soyuz Test Project."

Radio—Five weekly *Space Story* programs have been released: "Weather Mappers on Mars," (Adelson); "Apollo Soyuz Launch Director," (KSC/Kapryan); "Apollo Soyuz Flight Director," (JSC/Frank); "Apollo Soyuz: Astronaut Slayton"; and "Apollo Soyuz: Astronaut Brand." Two *NASA Special Reports:* "Apollo Soyuz Test Project." One set of NASA *Audio News Features*, pre Apollo Soyuz mission interviews.

Headquarters Press Releases

Issued by the Public Information Division, Code FP, Headquarters, Washington, DC 20546. These releases are available only to members of the news media.

75–91	NASA Gets New Graphics Identify
75–92	Catalog Lists Skylab Photos
75–93	Shaw University to Host NASA Space Symposium
75–94	Kenneth Woodfin Named Assistant Administrator for Procurement
75–95	Space and Nuclear Research and Technology Fact Sheet
75–96	Bubble Technology Promises Better Spacecraft Memory Systems
75–97	Soviets, U.S. Discuss Soyuz 18 Abort
75–98	Petrone Leaving NASA
75–99	Final ASTP Crew Training in USSR
75–100	12 Finalists Chosen in Viking Student Emblem Contest
75–101	SAS-C Press Kit
75–102	Nature Provides NASA Clues for Solar Energy Conversion
75–103	NASA Tests Noise from Business Jets
75–104	Rockwell Selected to Develop Two NASA Aircraft Test Vehicles
75–105	North Carolina College Symposium to Feature NASA Space Activities
75–106	Ultraviolet Light Tested in Hydrogen Production
75–107	Investigation Invited for Heat-Mapping Satellite
75–108	ASTP to Study Earth Mass Density Concentration
75–109	Apollo Soyuz Menus Listed
75–110	Three Apollo Soyuz Demonstrations Planned
75–111	ASTP Experiment Planned on Ultraviolet Absorption
75–112	David R. Scott Appointed Director of FRC
75–113	Telesat-C Press Kit
75–114	Vance Heads New Manned Space Flight Post
75–115	Conference on Medical Image Enhancing Techniques Scheduled
75–116	Space Pictures Guide Ship Through Antarctic Ice Field
75–117	Language to Pose No Barrier in Apollo Soyuz Flight
75–118	ASTP Press Kit
75–119	Baltimore Student Is Viking Contest Winner
75–120	Voice-Controlled Wheelchair Exhibited

Scientists Discuss Probing New Area of Solar System

European and American scientists, meeting in a symposium held at the Goddard Space Flight Center May 15–16, discussed the importance of a space mission designed to explore an area of the solar system never probed before.

During the meeting, prominent scientists delivered papers on the likely scientific returns of missions which, for the first time, would be flown out of the ecliptic plane (the pancake-like plane in which all planets orbit the Sun). Subjects discussed included solar physics, solar wind (plasma particles thrown off by the Sun), interplanetary magnetic fields, cosmic rays, interstellar gas, and interplanetary dust.

In discussing the symposium, its chairman, Dr. Lennard Fisk of Goddard, said: "A view of the solar cavity (the region dominated by the Sun through the flow of the solar wind, thought to extend beyond the orbit of Pluto, the last planet in the solar system) from out of the ecliptic plane is expected to expand greatly man's knowledge of interplanetary physics, solar physics, and the plasma processes in the universe. To place a spacecraft in such an orbit brings expectations that we will witness new and exciting phenomena that we could neither observe nor predict from our present vantage point in the ecliptic plane."

Much of the solar and interplanetary physics knowledge is based on NASA's and the European Space Research Organization's (ESRO) Earth-orbiting and interplanetary probes. All such probes have been confined near the ecliptic plane. The orbit of Earth itself is inclined only seven degrees to the solar equator.

Missions under consideration would be undertaken jointly by NASA and ESRO. Primary responsibility for the spacecraft would rest with the Europeans, while NASA would provide the launch vehicle.

NASA Telecommunications Expansion Economy Move

To reduce travel costs without loss of effective management of its widespread programs, NASA extended its Teleconferencing Network to include all major installations, as well as some principal Space Shuttle Program contractors.

The voice conference centers are backed up by a high speed facsimile network which can receive material for graphic support of oral discussions and conferences.

The expanded program will enable all major NASA installations to make use of the techniques and facilities used for communicating which were pioneered during the Apollo program.

Equipment already in operation or in process of being installed will enable large groups to participate in teleconferencing, with each installation having its own set of graphic data if needed.

***Pilot Congratulated**—USAF Gen. Duward Crow (Ret.), NASA Assistant Administrator for DOD and Interagency Affairs (left), recently visited Flight Research Center and watched an X-24B flight. In this photograph, he congratulates the pilot, Lt. Col. Mike Love, while the Center Director, Dr. David R. Scott (right), looks on.*

A pilot project, the NASA Teleconferencing Network, is scheduled to be in operation until the end of FY 1976 and is expected to effect significant savings in travel and energy costs.

Instructions for arranging a teleconference can be found in Center telephone directories or can be obtained by calling the Center telecommunications officer. Teleconferences can also be established through the MSFC Conference Control (phone: 205-453-4100). The MSFC contact for voice and facsimile network numbers is Jack S. McBride (phone: (205) 453-3460.

After each teleconference, an evaluation form should be filled out and sent to Richard Sprince or Sam Fordyce of EK/NASA Headquarters.

ASTP, Viking Cachets Planned

Kennedy Space Center will provide launch-day cancellations and cachets for the Apollo Soyuz Test Project mission and the twin Viking/Mars launches this summer.

Tentative launch dates are July 15 for ASTP, August 11 for Viking A and August 21 for Viking B.

Envelopes or covers will be accepted for KSC philatelic services up to the day before launch. In the case of delay in liftoff, mail will be held until the launch takes place and will be cancelled with the new date.

Projected Launch Schedule

(As of May 15, 1975)

Name	Launch Date	Vehicle	Range	Mission Remarks
Intelsat IV F1	May 22	A-Centaur	ETR	Continuation of Intelsat series of synchronous satellites providing commercial global telecommunications service to members of the International Telecommunications Satellite Consortium. Reimbursable.
Nimbus–F	June 11	Delta	WTR	Experimental meteorological satellite to test instruments for expanding capabilities for remote sensing of the atmosphere.
OSO–I	June 19	Delta	ETR	Scientific satellite to investigate a variety of specific features of the Sun.
ASTP	July 15	Saturn 1B	ETR	The U.S. launch for the U.S.-Soviet manned space flight. American astronauts in an Apollo Spacecraft will rendezvous and dock with Soviet cosmonauts in an orbiting Russian Soyuz spacecraft to test a new universal docking system and to conduct joint and unilateral experiments.
Marisat–A	July	Delta	ETR	Comsat Corp, satellite to provide maritime satellite communications service. Reimbursable.
Intelsat IVA-A	3rd Qtr	A-Centaur	ETR	First of a series of improved Intelsat Consortium satellites that will have almost double the capacity of the present Intelsat IV satellites. Reimbursable.
ITOS–E2	July	Delta	WTR	Operational meteorological satellite of the National Weather Service to provide day and night cloud cover imagery. Reimbursable.
EROS/ESA-COS-B	3rd qtr. (Aug.)	Delta	WTR	European scientific satellite to study extraterrestrial gamma radiation. Reimbursable.
Viking-A	3rd Qtr. (Aug.)	TIII-Centaur	ETR	Planetary mission to explore Mars from orbit around the planet with a capsule on its surface.
Viking-B	3rd Qtr.	TIII-Centaur	ETR	Planetary mission to explore Mars from orbit around the planet with a capsule on its surface.
Symphonie-B	3rd.Qtr.	Delta	ETR	Second joint French/German experimental communications satellite designed for TV, telephone, and data transmission. Reimbursable.
Navy	3rd Qtr.	Scout	WTR	Navy navigation satellite. Reimbursable.
Marisat–B	3rd. Qtr.	Delta	ETR	Second Comsat Corp. satellite to provide maritime satellite communcations services. Reimbursable.
Atmosphere-D	Sept	Delta	WTR	A scientific satellite to investigate the chemical processes and energy transfer mechanisms which control Earth's atmosphere.
Atmosphere-E	Sept.	Delta	ETR	A scientific satellite to investigate the chemical processes and energy transfer mechanisms which control Earth's atmosphere.
SMS–C/GOES–A	Oct.	Delta	ETR	First operational synchronous meteorological satellite of the National Weather Service of the Department of Commerce to provide continuous day and night global cloud-cover observations. Reimbursable.
Dual Air Density	2nd. Half (Nov.)	Scout	WTR	Two scientific spacecraft will be placed in orbit to obtain simultaneously measurements of the composition of upper and lower levels of the atmosphere.
RCA-A	4th Qtr	Delta	ETR	First of a series of domestic communications satellites for RCA. Reimbursable.
Comstar–A	4th Qtr	A–Centaur	ETR	Domestic communications satellite for Comsat Corp. Reimbursable.
Intelsat IVA-B	4th Qtr.	A-Centaur	ETR	Second of a series of improved Intelsat Consortium satellites. Reimbursable.
CAS-C/CTS	4th Qtr	Delta	ETR	Canadian-U.S. cooperative experimental communications satellite to develop and test the technology of high-power satellite television communications systems.
Relativity (Gravity Probe)	1975	Scout	WI	Scientific satellite to make a test of Einstein's Theory of Relativity.

1976				
HELIOS-B	Jan.	TIII-Centaur	ETR	Second West German/NASA cooperative satellite to investigate the properties of the processes in interplanetary space close to the Sun.
RCA-B	1st. Qtr.	Delta	ETR	Second domestic communications satellite for RCA. Reimbursable.
NATO-C	1st Qtr.	Delta	ETR	Communications satellite in synchronous orbit to perform communications relay for NATO. Reimbursable.
LAGEOS	1st Qtr.	Delta	WTR	Laser-reflecting satellite to demonstrate relevant space techniques that will contribute to the development and validation of predictive models for earthquake hazard alleviation, ocean-surface conditions and ocean circulation.
Comstar-B	1st Qtr	A-Centaur	ETR	Second Domestic communications satellite for Comsat. Reimbursable.
Intelsat IVA-C	1st Qtr	A-Centaur	ETR	Third of a series of improved Consortium satellites. Reimbursable.
Westar-C	April	Delta	ETR	Backup domestic communications spacecraft for Western Union. Reimbursable.
ESRO-GEOS	2nd Qtr	Delta	ETR	ESRO spacecraft to support space applications geoscience experiments in ocean topography measurements and solid earth physics. Reimbursable.
Comstar-C	2nd Qtr	A-Centaur	ETR	Third domestic communications satellite for Comsat. Reimbursable.
Marisat-C	1976	Delta	ETR	Comsat Corp. satellite to provide maritime satellite communications services. Reimbursable.

Patents for Inventions from NASA Research

The Office of General Counsel, NASA Headquarters, announces that the following U.S. patents have been issued by the U.S. Patent Office to NASA for inventions resulting from NASA research. Inquiries concerning them should be directed to the attention of the NASA Patent Counsel for the indicated installation.

Inventor(s) and Employer	Title and NASA Docket	Patent No.	Installation
Robert M. David and William M. Portnoy, Texas Tech Univ., Lubbock, TX	Insulated Electrocardiographic Electrodes (MSC-14,339-1)	3,882,846	JSC
Walter T. Appleberry, McDonnell Douglas Corp., Huntington Beach, CA	Device for Use in Loading Tension Members (MFS-21,488-1)	3,882,719	MSFC
Vitaly Danchenko, NASA/GSFC	Radiation Hardening of MOS Devices by Boron (GSC-11,425-2)	3,882,530	GSFC
Robert W. Fulcher and John Sudey, NASA/GSFC	Low Speed Phaselock Speed Control System (GSC-11,127-1)	3,883,785	GSFC
Taylor G. Wang, Melvin M. Saffren and Daniel D. Elleman, Caltech/JPL, Pasadena, CA	Material Suspension Within an Acoustically Excited Resonant Chamber (NPO-13,263-1)	3,882,732	NaPO
Rodger A. Cliff, NASA/GSFC	Digital Phase-Locked Loop (GSC-11,623-1)	3,883,817	GSFC
Robert L. Kurtz, NASA/MSFC	Holographic System for Non-Destructive Testing (MFS-21,704-1)	3,883,215	MSFC
Willard S. Blanchard, Jr., and Joseph L. Johnson, Jr., NASA/LaRC	High Lift Aircraft (LAR-11,252-1)	3,884,432	LaRC
Judd R. Wilkins and Stacey M. Mills, NASA/LaRC	Automatic Microbial Transfer Device (LAR-11,354-1)	3,884,765	LaRC
John E. Ohlson and William F. Williams, Caltech/JPL, Pasadena, CA	System for Interference Signal Nulling by Polarization Adjustment (NPO-13,140-1)	3,883,872	NaPO
Momtaz N. Mansour, Harold J. Wayland and Carl P. Chapman, Caltech/JPL, Pasadena, CA	Servo-controlled Intravital Microscope System (NPO-13,214-1 & 13,215-1)	3,883,689	NaPO
Richard R. Dedolph, NASA/ARC	Rotary Plant Growth Accelerating Apparatus (ARC-10,722-1)	3,882,634	ARC
Dah Yu Cheng, University of Santa Clara, Santa Clara, CA	Reversed Cowl Flap Inlet Thurst Augmentor (ARC-10,754-1)	3,883,095	ARC
Shui Yee Lee, Bell Comm, Inc., Washington, DC	Physical Correction for Improving the Optical Quality of an Image (HQN-10,542-1)	3,883,436	NaPO
Dean R. Harrson and John Dimeff, NASA/ARC	Diode-Quad Bridge Circuit Means (ARC-10,364-2)	3,883,812	ARC

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A Voice-Controlled Wheelchair

Over the years, NASA has made many outstanding advances in behalf of the severely handicapped. One of its most recent steps in this direction has been the development of a voice-controlled wheelchair designed especially for paralyzed persons.

Using space teleoperator techniques, engineers at the Jet Propulsion Laboratory developed the chair under a program sponsored jointly by NASA and the Veterans Administration. Outfitted with a chair-manipulator system capable of responding to 32 voice commands, it was exhibited in Washington recently to the President's Committee for Employment of the Handicapped.

Dr. Eward Heer, JPL Task Manager, said the chair was adapted from teleoperator and robot technology which has resulted from the space program. Operated electrically, it enables a person to start the motors and the voice-command analyzer by pressing the back of head or chin against either of two switches.

The patient wears a microphone to command the movements of the chair and the manipulator arm, which can be extended from one to four feet to pick up things with its two pincer-fingers. The vital Voice-command analyzer—actually a minicomputer—will accept selected one-word commands, such as ready, go, stop, arm, up, down, left, right, open, close, forward, backward.

In addition, more pretrained command sequences could be stored in the chair's computer memory by expanding its present 32-word memory capability. These would enable the patient merely to initiate complex repetitive actions such as moving a fork or spoon between a plate and his mouth.

Heer said the system has been refined to about 97 percent efficiency. Further development is expected.

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